

The 'Instructional Uses of School Computers' Newsletters -- What's Next?

The next issue of this newsletter examines differences between schools and students in how they use computers — differences between high- and low-achieving students, between boys and girls, and differences among cities, suburbs, and rural parts of the country. Issue 2 also looks at the perceptions of teachers and principals about the consequences of computer use for their students and schools.

Issues 3 through 6 will focus on specific uses of computers in a variety of curricular areas:

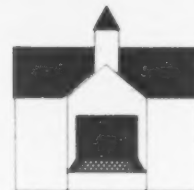
mathematics, science, writing, language arts and reading, computer literacy, computer programming and problem-solving, social studies, and vocational programs. In contrast to the more global assessments and statistics presented in the first two issues, the data in issues 3 through 6 will come principally from individual teachers about their use of computers with particular classes of students. Both elementary and secondary schools will be covered in each issue.

The Johns Hopkins University
Center for Social Organization of Schools
3505 North Charles Street
Baltimore, MD 21218

Nonprofit Org.
U.S. Postage
PAID
Baltimore, MD
Permit No. 1235

Cheryl Wallick
Congressional Information
Service
4520 East-West Highway
Bethesda, MD 20814

Instructional Uses of School Computers



Reports from the 1985 National Survey

Issue No. 2, August 1986

Center for Social Organization of Schools

The Johns Hopkins University

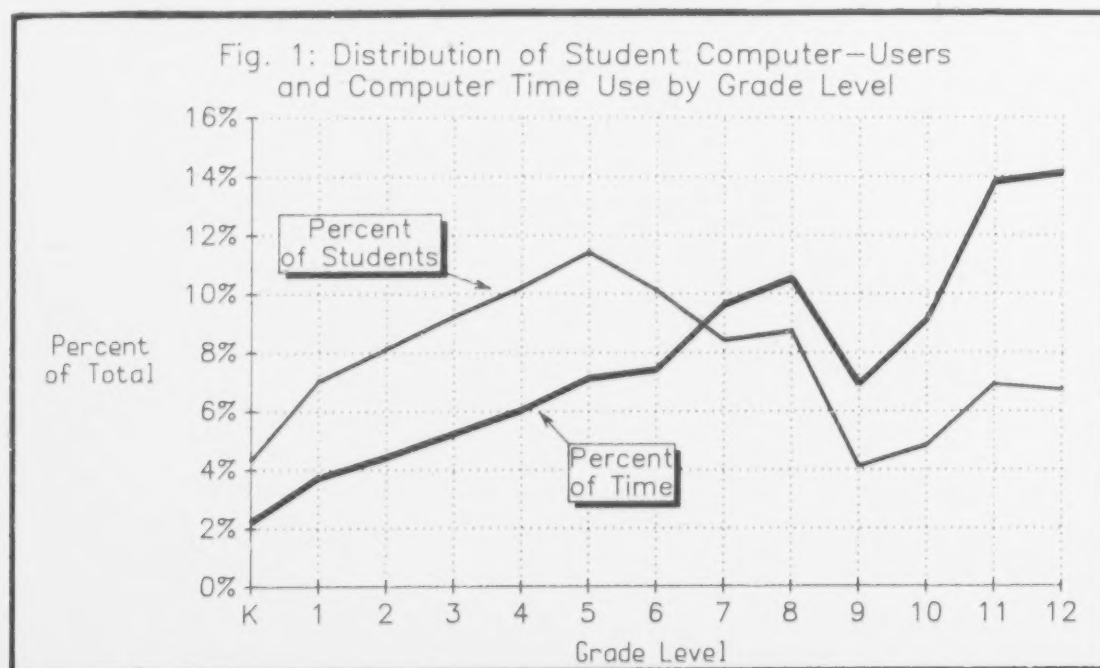
Henry Jay Becker, Project Director

Is there a fair distribution of computer resources across different groups of students in U.S. schools? That is not an easy question to answer. Fairness does not necessarily imply that all students use a particular resource equally, because the needs and interests of students differ. Some students may profit more from using computers than others. However, data about how equally computer resources are distributed will contribute to understanding the fairness or equity of computer use in schools.

In this report, the second of six to be issued from the Second National Survey of Instructional Uses of School Computers, we present data on how computer access and use differs across different grade levels, between male and female students, among high-, average-, and low-achieving students

and classrooms. We will also report differences in the use of school computers across different types of communities from farming communities to high-income metropolitan neighborhoods to schools mainly enrolling minority students.

Figure 1 is our starting point. It shows how all school computer time (the thick line) and all student users (the thin line) are divided among each grade level from kindergarten through the 12th grade. In the previous newsletter, we had indicated that the proportion of students who used computers was greatest for elementary schools and lowest for high schools, but that the amount of computer time spent by each student user was much greater in high schools than in middle or elementary schools. Figure 1 shows similar results, but it contains some interesting data for individual grades within these broad levels of schooling.



At the elementary level, both the number of student users and the total amount of use increase for each grade from kindergarten to grade five. Thus, substantially more fifth graders used computers in 1985 than did first graders, and fifth graders got nearly twice as much computer time in the aggregate than did first graders. At the middle school level, the total number of student users declines, but the total computer time used by students goes up sharply between the 6th and 7th grade.

At the high school level, both measures of use in Figure 1 shift sharply. At grade nine, substantially fewer students spend substantially less time using computers than in the previous grade. In all, about the same number of 9th grade students use computers as kindergarteners, and their aggregate computer time is equivalent to the time spent by fourth or fifth graders. High school computer use, as Figure 1 shows, is clearly dominated by juniors and seniors. The top two grades comprise 60% of the high school users and occupy nearly two-thirds of the instructional time on high school computers.

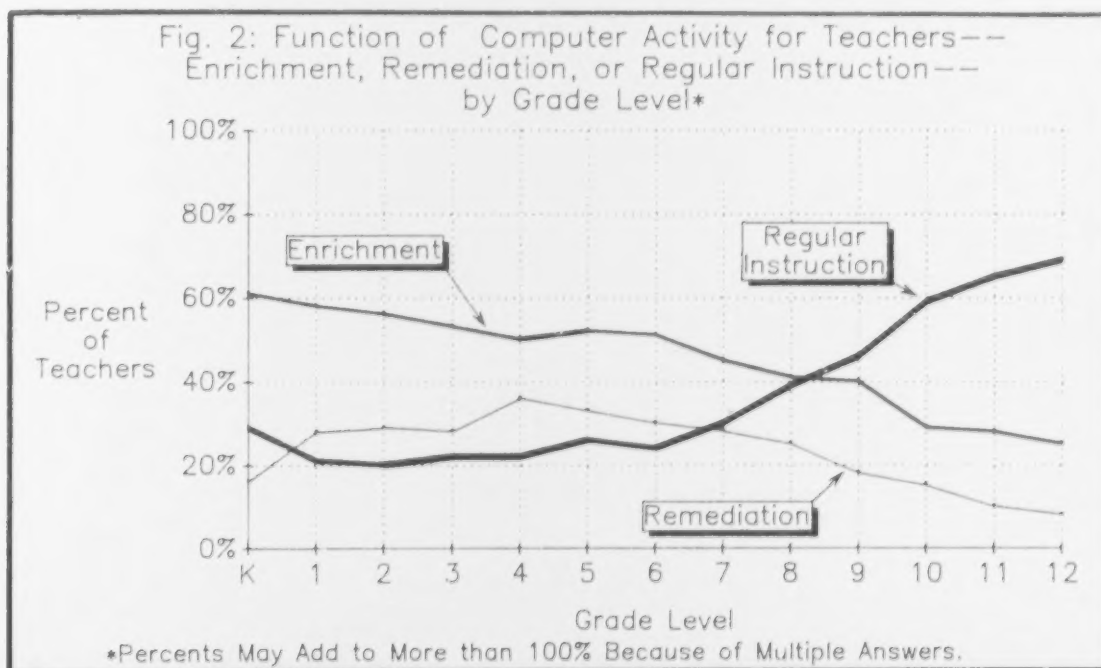
Regular Instruction, Remediation or Enrichment

In each classroom at every grade, some activities are more central to that class's instructional focus than are others. How central a role do computers play in instruction at different

grade levels? We asked teachers about their use of computers for one (randomly sampled) class or subject. Our respondents were asked whether computer use for that particular class was a regular part of instruction in that subject or whether instead computers were used primarily for "enrichment" or for "remediation." (A few gave more than one answer.) Figure 2 shows how the teachers' responses differed by grade level.

From kindergarten through the 8th grade, the most common response was that computers were used primarily for enrichment. A majority of teachers from kindergarten through the sixth grade gave this response as did two-fifths of teachers of seventh, eighth and ninth grade classes. Computers also play a remediation role from the first through the seventh grade, but never does remediation represent much more than one-third of all computer use.

Until the secondary grades, computers are seldom seen as integral to class instruction. Only for the high school grades were computers seen primarily as a regular part of instruction. Yet this was clearly the main function of computers in the eleventh and twelfth grades, where high school use was most common. The proportion of teachers indicating the "regular instruction" role for computers shot up dramatically from 39% for eighth grade classes to 59% for 10th grade classes to 69% for twelfth grade classes.



Thus, while more students use computers at the younger grades, high school students who do use computers use them for much longer periods and more often as a regular part of class instruction. The high school class is most often a class about computers rather than a class using computers as an instructional medium or a productivity tool, but high school is the one level where computers most often function as an integral rather than a supplementary part of the subject taught.

Differences between Boys and Girls

Computer use also differs substantially between boys and girls, although not everywhere and not in all respects. Table 1 presents some global assessments of the proportion of student computer-users who are girls. Figures are shown for various ways of using computers and for different school levels — K-6 (or K-5) elementary schools, middle (or junior high) schools, and high schools.

For each aspect of computer use (before or after school, word-processing, elective computer programming classes, computer game playing, and overall use) the table shows the median percentage of users who are girls (among schools reporting that kind of use). The median gives the "typical" share of computer use going to female students. But this share varies substantially across schools, so Table 1 presents two other sets of statistics. The columns titled "20th percentile" report a statistic about the schools with the least female participation in that type of computer use. Specifically, it shows the maximum "percent female" among the 20% of schools with the lowest proportion female among computer users. The columns titled "80th

percentile" provide data about the 20% of schools with the highest proportion female (the minimum percent female among the schools in the "top 20%").

The medians indicate a rough parity between boys and girls for two aspects of computer use at all three school levels. Overall use and word-processing, on average, are activities where the participants are roughly 50% boys and 50% girls. In addition, playing computer games involves as many girls as boys in elementary school, but not in middle or high school.

Somewhat surprisingly, considering the conventional wisdom on the subject, enrollments in elective programming classes in the middle and high schools in our sample were also roughly evenly split between male and female students, with the typical school reporting 45% female in these activities. We confirmed this result with more detailed information from high school computer programming teachers on the composition of the programming classes that they taught. Girls typically constituted 50% of the students in high school programming classes requiring algebra or higher mathematics as a prerequisite, but they were only 40% of the students in courses without a substantial mathematics prerequisite and 42% in the typical "advanced" programming class.

On the other hand, most computer-using schools reported substantial male dominance in several other areas. In schools where the computer was used either before or after school, boys outnumbered girls three to one. At the typical middle school, for example, only 15% of the before- or after-school users were girls. Boys also dominated elective programming activities in

Table 1: Distribution of Computer Use by Girls for Elementary (K-6), Middle, and High Schools as Reported by Each School's Primary Computer-Using Teacher, Spring, 1985.

	Median Percent Use by Girls (50th Percentile)			Low Percent Use by Girls (20th Percentile)			High Percent Use by Girls (80th Percentile)		
	Elem. (K-6)	Middle School	High School	Elem. (K-6)	Middle School	High School	Elem. (K-6)	Middle School	High School
Overall Use	50%	50%	50%	50%	40%	35%	50%	50%	50%
Before/After School	30%	15%	20%	0%	1%	3%	50%	50%	50%
Word Processing	50%	50%	60%	0%	6%	45%	50%	50%	80%
Elective Programming	9%	45%	44%	0%	20%	30%	50%	50%	50%
Game Playing	50%	30%	10%	20%	5%	2%	50%	50%	40%
Use Index*	45%	38%	40%	30%	26%	29%	50%	50%	51%

*Additive index of non-missing entries on previous five aspects of use.

elementary school and game-playing in middle and high school.

In all aspects of computer use measured, male users outnumbered females in at least some schools. (See the columns titled "20th Percentile" in Table 1.) In contrast, there were very few schools where girls were dominant in any area, except in high school word-processing. (Most high school word processing occurs in business education courses where girls comprise most of the enrollment.) The right-most columns of Table 1 show that — except for word-processing — the 20% of schools with the greatest female participation still show almost uniformly a 50-50 split between boys and girls. Thus, disproportionate use of computers by boys occurs frequently, whereas disproportionate use by girls is almost non-existent.

Our survey asked individual computer-using teachers about the sex distribution of the computer-using students who they themselves had taught. In particular, we asked these teachers to indicate the sex of the "three students (who) have been most affected by their experience with computers in school." About 38% of the students identified by elementary school teachers were girls; 62% were boys. At the secondary school level, teachers named even fewer girls. Females were only about one-third of the secondary school nominees. Moreover, the first person named by each teacher was overwhelmingly likely to be a boy — 74% at the elementary level and 78% at the secondary level.

Yet when asked HOW computers had affected these students, elementary and middle grade teachers who had named a girl were more likely to say that computers had helped her academically. Male elementary and middle grade nominees were more likely to be affected in terms of behavior and attitudes — such as improvements in self-confidence, self-discipline, or motivation.

Differences by Student Ability

As much as boys dominate computer use, higher-ability students use computers at least as disproportionately. Figure 3 shows one example of this. Each school's "primary computer-using teacher" was asked to think of the dozen or so students who "most actively use school computers" and to report roughly how many of them were in the top-third of their class, how many were in the bottom-third, and how many were female.

At all school levels, more respondents said that the "top-third" students were overrepresented among the most active dozen than indicated that "boys" were overrepresented. "Bottom-third" students were overrepresented about as often as they were underrepresented in elementary schools, but they were more often underrepresented in middle schools and even more underrepresented in high schools.

Figure 4 provides other evidence about the dominance of upper-ability students in most types

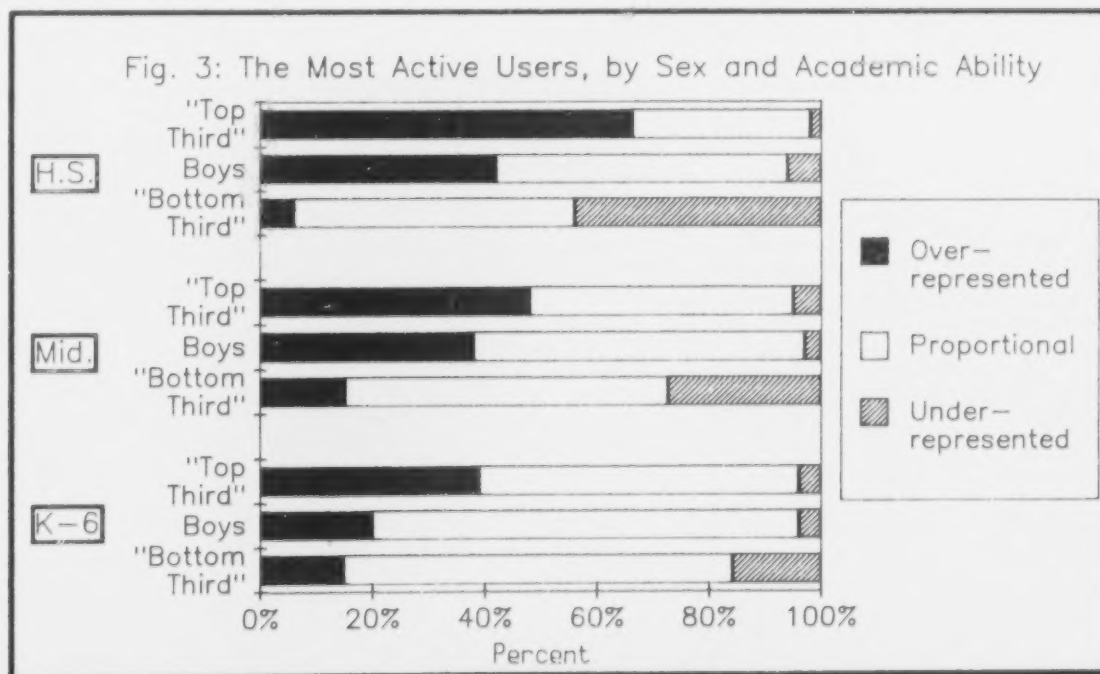
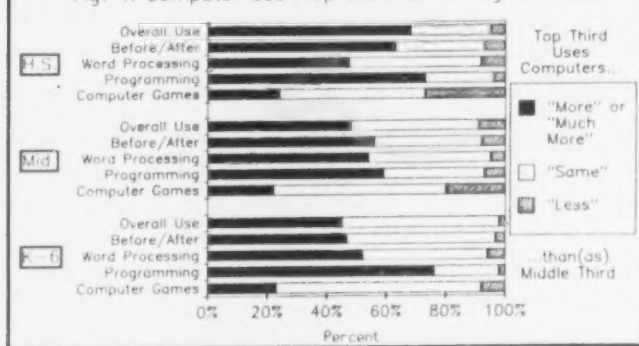


Fig. 4: Computer Use: Top Third vs. Average Students



of computer activities at all school levels. Compared to average students (those in the "middle-third" of their class), "top-third" students used computers more overall, more before- and after-school, more in word-processing, and much more in elective programming. Upper-ability students did not, however, dominate in the playing of computer games.

The use of school computers affects upper-ability and lower-ability students differently. In identifying students who were most affected by using school computers, teachers responded very differently for students whose school performance was "high" or "very high" than they did for students they identified as doing less well in school. Figure 5 summarizes these differences.

By far the most frequently reported effect of computers on lower-ability students was in improved motivation, self-confidence, and self-discipline. These behavioral and attitudinal consequences were mentioned much less often for higher ability students, particularly at the high school level. In contrast, teachers reported that computers helped higher-ability students primarily with higher-order thinking skills, programming skills, writing, science projects, out-of-school activities, career preparation, real-world experience, and other activities which the figure labels "high ability academic direction." Lower-ability students also received academic help from their computer work but primarily for developing basic skills in mathematics, reading, and language.

Computer Use for School Subjects, by Grade Level

Computers may affect students of different academic abilities differently in part because such students use computers for different school subjects. This section examines how computers are used by school subject, first by grade level and then by the ability-level of classes within the same grade span.

The first newsletter briefly discussed the distribution of computer use by subject-matter in

Fig. 5: How Most-Affected Students Were Helped (by Grade Level & Ability)

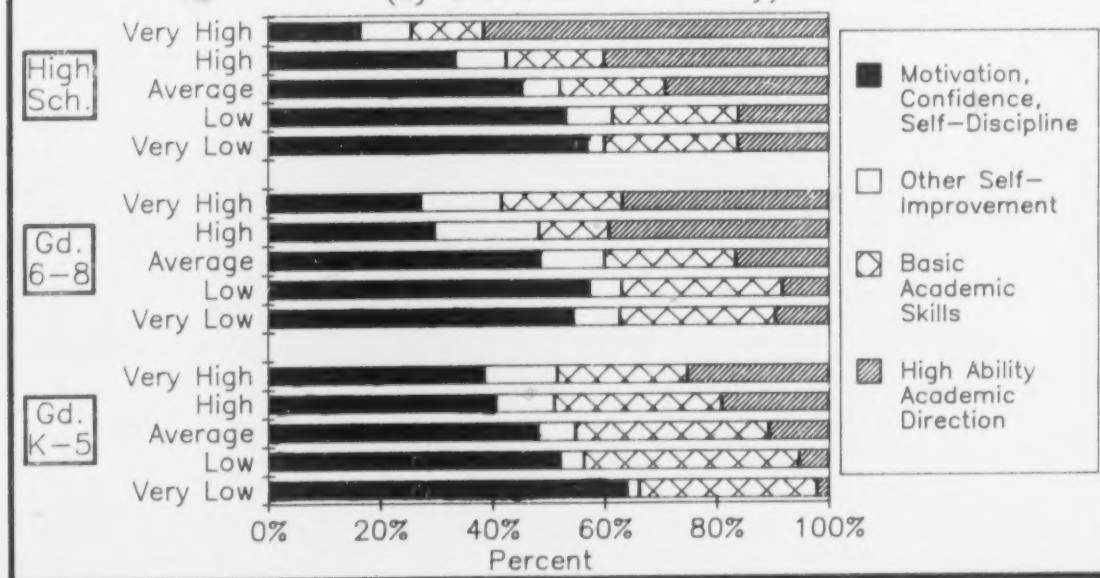


Table 2: Distribution of Computer Use, by Subject and Grade Level, Spring, 1989.*

SUBJECT (from course title, activity, and software in use)	GRADE LEVELS OF STUDENTS IN CLASS		
	K-3	4-8	9-12
Mathematics**			
Topics below algebra or unspecified math	42%	27%	5%
Algebra, geometry	0%	1%	1%
Trig., advanced math	0%	0%	1%
Subtotal: traditional math subjects	42%	28%	7%
English			
Language arts and spelling	18%	12%	4%
Reading	17%	8%	2%
Subtotal: language arts	35%	20%	6%
Writing	2%	2%	3%
Word processing in English class	3%	3%	2%
Subtotal: writing	5%	5%	5%
Computers and Problem-Solving			
Math topics: problem-solving, logo, programming activities	3%	6%	2%
Programming*** as specific topic or course	2%	13%	42%
Logo as specific topic****	4%	1%	1%
Computer literacy as specific topic or course	6%	10%	5%
Subtotal: computers & problem-solving	14%	34%	50%
Business and Word Processing			
Business, accounting, secretarial, other than word processing	0%	0%	6%
Word processing, other than in English	1%	2%	12%
Subtotal: business	1%	2%	18%
Other Subjects			
Science and nutrition	1%	3%	7%
Social studies	1%	4%	1%
Industrial arts and agriculture	0%	1%	5%
Others	2%	2%	2%
Subtotal: other subjects	4%	11%	15%
Total for All Subjects	100%	100%	100%

*Sum of individual entries may not equal subtotal entry because of rounding. Similarly, subtotals may not sum to grand total.

**See also first entry under 'Computers.'

***Excludes specific mentions of Logo.

****Includes some general problem-solving not classified elsewhere.

the context of showing how lab and classroom environments differ. Here we look specifically at the subject and topic of instruction. Table 2 presents results by grade level, but we have collapsed the thirteen grades into three categories: early elementary (K-3), late elementary and middle (4-8), and high school. The data is from one randomly sampled class or subject taught by each computer-using teacher. In particular, the data refer to the computer activity most recently engaged in by students in that class. Each class is weighted according to how much it used computers during the year, so percentages give the approximate proportion of total use.

In grades K-3, whole number arithmetic and language arts, including spelling and reading, constituted three-quarters of all use of computers. (41% for arithmetic; 35% for language arts.) This includes time spent during "computer literacy" units where students were engaged in math or language drills. General instruction about computers, programming, use in teaching logic and problem-solving skills and use in writing together constituted only about 20% of the time spent with computers by K-3 students.

At the other age extreme, in grades nine through twelve, one-half of all student computer activity was concentrated in computer programming (and some computer literacy) courses and topics. Another 19% was spent in business, typing, and word-processing courses (outside of writing courses in English). There was relatively little use in traditional mathematics subject-matter (7% of all high school computer activity) or science courses (7%), and English activity was split between language arts drills and tutorials (6%) and writing activities (5%). The aggregate proportion of time on computers in industrial arts and agriculture classes (5%) was roughly the same as that for mathematics, science, language arts, or writing.

Perhaps the most diverse use of computers in the survey appeared in the late elementary and middle grades. There was substantial use for arithmetic, algebra and other traditional math topics (28%) and significant use in language arts and reading (20%). But there was also substantial use for subjects where the computer was primarily the object of instruction rather than the means of instruction. Computer literacy (including "logo" activities) occupied about 15% of middle-grade computer time and more conventional instruction in programming languages occupied another 13%. Additional computer time was spent on higher-order problem-solving skills in math (6%), writing and word-processing (7%), and use in social studies (4%) and science (including nutrition, 3%).

High-Ability, Mixed-Ability, and Low-Ability Classes, Grades 4-8

In the middle grades and in the upper grades, how computers were being used differed widely according to the ability levels of the students enrolled in the class. Each computer-using class sampled in the survey was categorized as enrolling (a) primarily very high ability or "gifted" students, (b) primarily very low ability or learning disabled students, or (c) average students or students of mixed academic abilities. Only teacher- or school-designated special classes were distinguished, so that most computer-using classes were in the "average" or "mixed" category. Table 3 shows the distribution of computer activities by subject, as in Table 2, but separately for low-, mixed-, and high-ability classes. The first three columns contain data for grades 4 through 8; the last three, for high school grades.

The pattern of computer use in low-ability classes in grades four through eight strongly resembles the overall pattern for all classes in kindergarten through grade three. (Compare with Table 2.) Three-quarters of computer activity in these classes emphasizes basic math and language arts skills. These classes do not share the emphasis on computer-specific and higher-order skills found at the same school level in mixed-ability classes and even more so in high-ability middle-grade classes. (These statistics, though, refer to classes rather than individual students. It is possible that many students in low-ability math and English classes are re-grouped into heterogeneous classes for computer topics and problem-solving.)

In the middle grades, computers are much less often used in language arts instruction in mixed- and high-ability classes than in low-ability classes. They are also much less prevalent in high-ability

math classes (on math topics) than in mixed- or low-ability classes. High-ability classes in these grades make more use of computers for writing than do other classes, but writing occupies only about 10% of the computer time of these high-ability classes. Social studies and science (primarily in the form of programs about nutrition) make up another 10% or so of computer use in high-ability classes.

However, it is computer programming that stands out as the most substantial aspect of high-ability classes' use of computers in the middle grades. Programming, computer literacy, and problem-solving activities account for 60% of the computer time in these classes. Altogether, two-thirds of the class computer time is devoted to higher order thinking, writing, and programming activities for high-ability groups. In contrast, these uses take up only about 40% of the computer time for mixed-ability classes and less than 20% for low-ability classes.

Table 3: Distribution of Computer Use, by Subject and Ability Level, Upper-Elementary through High School, Spring, 1985.*

SUBJECT (from course title, activity, and software in use)	GRADE AND ABILITY LEVELS OF STUDENTS IN CLASS					
	Grades 4-8			Grades 9-12		
	Low(29%)	Mixed(59%)	High(12%)	Low(13%)	Mixed(78%)	High(9%)
Mathematics**						
Topics below algebra or unspecified math	36%	27%	9%	32%	1%	0%
Algebra, geometry	2%	1%	3%	1%	1%	2%
Trig., advanced math	0%	0%	0%	0%	1%	3%
Subtotal: traditional math subjects	38%	28%	12%	32%	3%	5%
English						
Language arts and spelling	20%	10%	4%	16%	2%	1%
Reading	19%	5%	2%	13%	0%	2%
Subtotal: language arts	39%	15%	6%	29%	2%	3%
Writing	5%	1%	6%	4%	2%	9%
Word processing in English class	1%	3%	4%	5%	1%	5%
Subtotal: writing	6%	4%	10%	9%	3%	14%
Computers and Problem-Solving						
Math topics: problem-solving, logo, programming activities	4%	6%	10%	3%	1%	2%
Programming*** as specific topic or course	2%	14%	25%	4%	50%	32%
Logo as specific topic****	3%	6%	8%	2%	1%	1%
Computer literacy as specific topic or course	4%	12%	18%	6%	5%	4%
Subtotal: computers & problem-solving	13%	38%	61%	15%	57%	40%
Business and Word Processing						
Business, accounting, secretarial, other than word processing	0%	1%	0%	0%	7%	2%
Word processing, other than in English	2%	1%	2%	6%	13%	11%
Subtotal: business	2%	2%	2%	6%	20%	13%
Other Subjects						
Science and nutrition	1%	5%	2%	2%	6%	18%
Social studies	0%	6%	6%	3%	1%	3%
Industrial arts and agriculture	0%	1%	0%	2%	7%	0%
Others	2%	3%	3%	3%	2%	3%
Subtotal: other subjects	3%	14%	10%	9%	15%	24%
Total for All Subjects	100%	100%	100%	100%	100%	100%

*Sum of individual entries may not equal subtotal entry because of rounding. Similarly, subtotals may not sum to grand total.

**See also first entry under 'Computers.'

***Excludes specific mentions of Logo.

****Includes some general problem-solving not classified elsewhere.

Mixed-ability computer-using classes in the middle grades suffer from a poorer ratio of students to computers than do either low- or high-ability classes. The mixed-ability classes tend to be somewhat larger than the gifted classes (and much larger than the special education classes), and they have fewer computers available to them. Where classes use computers in their own classroom rather than in a separate lab (and about three-fifths of the classes in these grades do), mixed-ability classes have a median ratio of 20 students per computer. So, they typically have only one or two computers in their classroom. High-ability classes using computers in their room have a median 10-1 ratio, and low-ability classes typically have an even better 5-1 ratio. High-ability classes are more likely than either of the other types to use computers outside of the classroom, in a laboratory or library, where the student-to-computer ratio is much better (typically 1-1).

Students and teachers in high-ability classes are more likely to have a computer at their own home than are other middle grade computer-using students and teachers. Among teachers of the high-ability classes, 47% have a home computer compared to 28% of the other computer-using teachers. And in more than 90% of the high-ability classes, at least three students have a home computer. This compares with about 60% for the mixed-ability classes and only 20% for the low-ability classes (which, however, have fewer students). On the other hand, substantial experience in formal teacher training does not markedly distinguish computer-using teachers of the high-ability classes from those of mixed- or low-ability classes. They are only modestly more likely to have had 50 hours or more of training in using computers for instruction (32% vs. 25%).

Class Ability Levels -- High School

In high school, low-ability classes continue to use computers primarily for pre-algebra mathematics and for language arts skills. The mixed-ability classes are heavily concentrated in computer programming, business, and word-processing. More than three-quarters of their activity is in these areas. Only 6% of the computer work in average or mixed-ability classes is in

science, only 3% in traditional mathematics coursework, 3% in writing, and only 2% in language arts. Interestingly, a smaller proportion of "high ability" high school computer classes involves programming than is the case for "mixed-ability" classes (32% vs. 50%). More detailed information about the classes indicates that students enrolled in typical high school programming classes are generally "higher than average" in ability, but only a very small minority of these classes have mainly "very high ability" students. Consequently, few programming classes qualify for the "high ability" category of Table 3.

High-ability high school classes use computers in writing and in science much more than do mixed- or low-ability classes. Together, writing and science constitute about one-third of the computer work of high-ability high school classes. Relatively little of the computer work of high-ability classes is for advanced mathematics courses (5%).

That students in different academic ability groups use computers so differently is not surprising. Nor is it necessarily inequitable. It merely indicates that computers permit a great variety of instructional activities and that the educational needs of different students vary. But computer tasks vary among students also because some computer applications and much of the available software requires students to confront and solve operational problems and make decisions without close adult supervision, and some students are more able to do that than others. Extending to less able students applications that emphasize higher-order thinking and problem-solving requires software that is comprehensive and easy to use. Provision also must be made for the time that students spend awaiting their turn on the computer.

On the other hand, we encountered some unexpected areas of the curriculum that employed computers in a relatively minor way. In particular, our survey found that in 1985 there was little use of computers in mathematics classes beginning with algebra, particularly in the highest level high school mathematics courses, such as trigonometry. Also, use of computers in secondary science and social studies courses was mainly limited to advanced high school science courses in physics, chemistry, and biology, and to using simple simulation games in middle-school social studies courses.

Computing Across the U.S.: Computer Use by Community Type

As we have seen, student grade levels and school performance levels both significantly affect the type of computer experience offered by the school. The type of community where a student lives also affects a student's access to computer time and affects how that student is likely to use computers.

In this section, we examine seven groups of schools classified by the community where the school is located and the socio-economic characteristics of students who attend them. The seven groups of schools are: (1) schools where many students come from relatively high socio-economic backgrounds and which are located in metropolitan areas (here called "High SES schools"); (2) schools located in metropolitan areas and that have a racially mixed or predominantly minority student body ("Black/Mixed schools"); (3) metropolitan area schools that are primarily white and non-Hispanic but where students typically come from a low socio-economic background ("Low SES schools"); (4) other schools in metropolitan areas of over one million people ("Large Metro schools"); (5) other schools in smaller metropolitan areas ("Small Metro"); (6) schools where most students are from farm families ("Farm"); and (7) other schools in areas outside of metropolitan areas ("Small Towns").

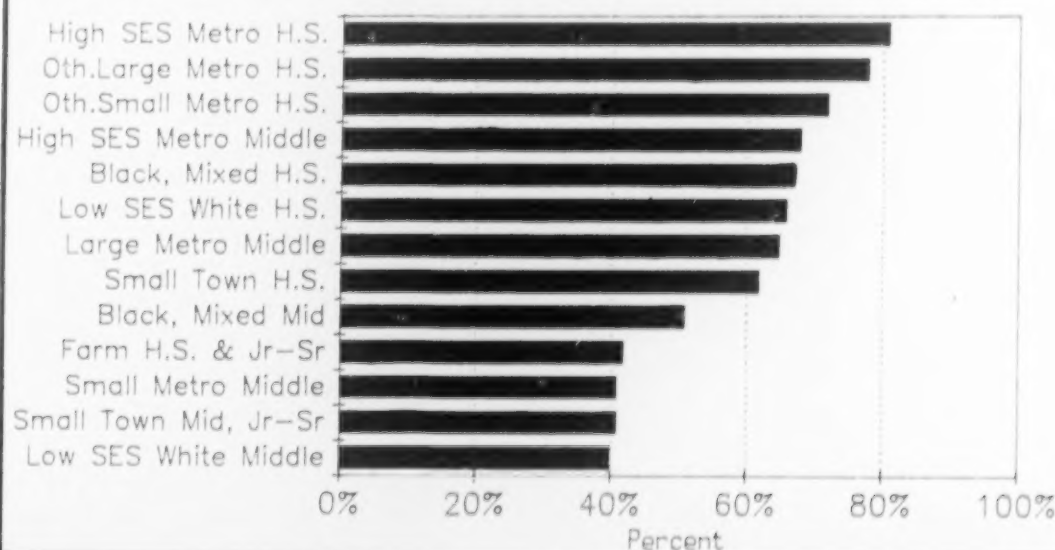
By 1985, most elementary schools used at least one computer for instruction. High SES schools

and K-6 schools in smaller metropolitan areas were the most likely to have a computer -- roughly 90% did. Farm schools, low SES K-8 schools, and racially mixed and minority elementary schools were the least likely to have a computer. Nevertheless, even three-quarters of those schools had a computer.

On the other hand, few elementary school students attended a school that had at least 15 computers -- enough to serve perhaps one-half or one full class at the same time. Fewer than one-fifth of the students in elementary schools in large metropolitan areas or high SES schools attended a school with that many computers in 1985, and these were the types of schools MOST likely to have 15 or more computers. Thus, geographic location and socio-economic variables probably did not significantly affect overall access of elementary school children to computers in 1985.

Among secondary schools, these community characteristics appear more relevant to computer access. (See Figure 6.) Certain types of secondary schools were far less likely to have had 15 or more computers in the Spring of 1985 than were other types of schools. In particular, 15 or more computers were available in only about 40% of low SES middle schools, small town middle and junior-senior highs, small metropolitan area middle schools, and high schools and junior-senior highs in farming communities. In contrast, two-thirds of high SES middle schools, and about four-fifths of large metropolitan area and high SES high schools

Fig 6: Percent of Secondary Schools With 15 or More Computers



had 15 or more computers. Actually, the seven community types differed less in their typical "student-to-computer" ratios than in the likelihood that they had 15 computers. But for schools, where the organizational problem of serving classrooms of students is paramount, having 15 computers might be a reasonable minimum for serving students in instructional groups, regardless of student-to-computer ratios.

Of course, without teachers knowledgeable about using computers, having many computers is no advantage. Our study measured the expertise of computer-using teachers in two ways, but we refer here only to one of them: a report by each school's primary computer-using teacher of the number of teachers who were "expert" in (a) using instructional programs, (b) knowing about a wide variety of programs, (c) using computers as a professional tool, and (d) having programming skills. Figure 7 shows the average "expertise" index (on a scale from 0 to 100) of computer-using teachers at schools categorized by grade span and type of community.

As reported in the previous newsletter, few computer-using elementary teachers are "computer experts." This is understandable considering the broad instructional responsibilities of elementary

school teachers. Consequently, differences in teacher computer-expertise are generally small across elementary schools in different types of communities. But at the secondary level, schools in some types of communities have a higher proportion of experts among their computer-using teachers than do schools elsewhere.

Computer-using teachers at High SES high schools have more expertise than those at other high schools. High schools in farming communities are staffed by less expert computer-using teachers. High SES middle school computer-using teachers also are more expert than teachers at middle schools in other types of communities. Other communities have basically similar patterns of teacher computer expertise.

We saw earlier that, starting in the upper elementary grades, high-ability classes of students use computers for different academic purposes than do students in mixed-ability and low-ability classes. Although there are some high-, average-, and low-ability classes in schools in all types of communities, the aggregate pattern of computer use in schools is likely to be affected somewhat by aggregate differences in how well students in these communities do academic work. However, between-

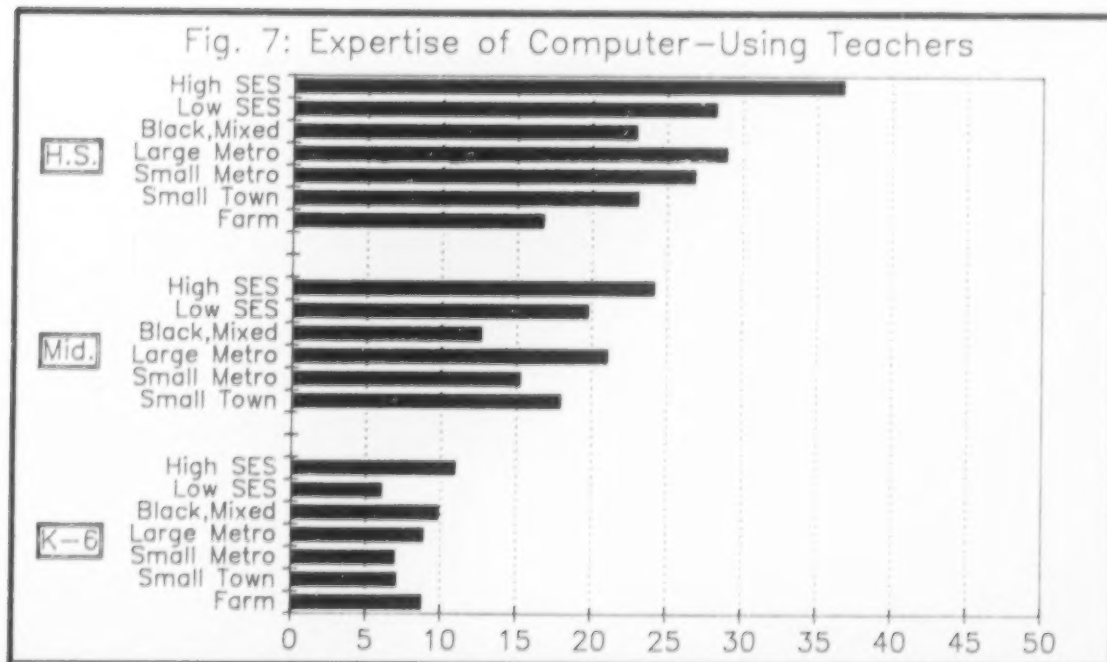
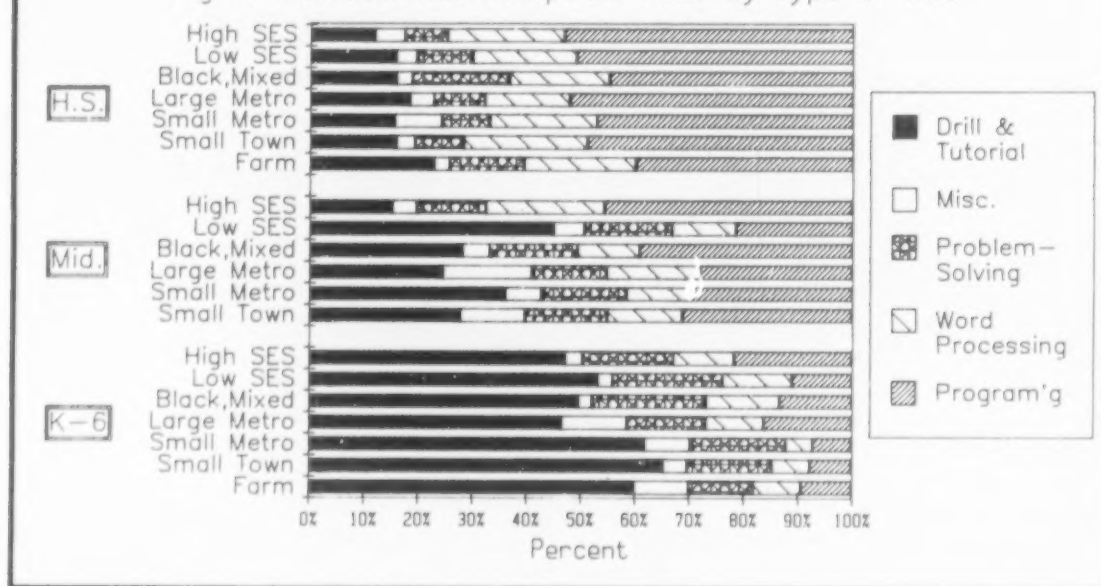


Fig 8: Instructional Computer Time by Type of Use



community differences in how computers are used in schools may also reflect other factors, such as teacher expertise and the value placed on computer skills in the local culture.

Figure 8 shows the distribution of computer time at schools in various types of communities. The table shows some basic similarities across communities in how schools of the same grade span allocate computer time. For example, at the high school level, the proportion of time going to programming activities varies only from 40% for high schools in farming communities to 53% for high SES high schools. The remaining groups of high schools are in the narrow range of 45% to 52%. The proportion of time going to word-processing in high school varies only between 16% and 22% among the seven types of communities.

But in some respects there are rather sizable differences among the communities. Programming in middle and junior high schools varies from occupying 22% of the computer time in low-SES predominantly white middle schools to 46% of the time in the high-SES communities. The other groups of schools are scattered in-between. Correspondingly, computer-assisted instruction ("drills and tutorials") occupies only 15% of the computer time in high-SES middle schools compared to 45% in low-SES predominantly white middle schools.

Among K-6 elementary schools, the proportion of time in drill and tutorial activities varies from a low of 46% ("Large Metro") to a high of 65% ("Small Town") and the proportion of time in programming activities varies from 7% ("Small Metro") to 22% ("High SES"). "Discovery learning and problem-solving" activities occupy 21% of the computer time in racially mixed and minority metropolitan elementary schools but only 12% in elementary schools in farming communities.

Of the various differences indicated in Figure 8, the most consistent one is that more programming activity occurs in schools in metropolitan areas with students from high socioeconomic backgrounds. Although these results are shown in terms of an economic variable (SES), more detailed analyses of the data suggests that between-school differences in the ways computers are used are better accounted for by differences in student academic achievement than by socioeconomic differences. This is especially so for the differential in programming activities. We only note here that high SES schools lose their distinctive pattern with respect to programming activities when we get to the high school level. At that level, programming courses have moved from the narrow "gifted-and-talented" area to the more inclusive "college prep" track.

Conclusions

Our findings indicate substantial differences in access and use of school computers in terms of student ability and sex. However, as we suggested at the start, equitable allocation of school resources is not merely a matter of giving every student an equal amount of computer time and an identical set of instructional tasks. If students had identical backgrounds, needs, goals, and interests, that might be the case. However, because these assumptions are not true, an equitable allocation of computer use depends upon the relative educational value of computer-based activities for different groups of students needing instruction of different form and content. Concrete evidence about the immediate and longer-term impact of computer-based instruction, computer literacy curricula, and computer applications is clearly insufficient at this time. To know how fair the distribution of computer experience is -- and to know how effective these experiences have been -- we must begin to measure actual consequences for students by systematic field studies of alternative instructional programs.

The Johns Hopkins University
Center for Social Organization of Schools
3505 North Charles Street
Baltimore, MD 21218

How effective is computer-based instruction? Our survey data gives us no definitive answers. We did no direct evaluation of student computer users. But we do know how the teachers who provided computer experiences perceived their impact. In the next newsletter, we will report these perceptions of teachers and principals and how the perceived consequences for students differ by the type of computer experience provided. We will also begin our more detailed curriculum-specific coverage with descriptions of how computers are being used with traditional mathematics and science subject-matter.

SUBSCRIPTION INFORMATION

The complete series of six newsletters is available by subscription for \$7.50, payable to The Johns Hopkins University. Write to Computer Survey Newsletters, Center for Social Organization of Schools, Johns Hopkins University, 3505 N. Charles St., Baltimore, MD 21218.

Nonprofit Org
U.S. Postage
PAID
Baltimore, MD
Permit No. 1235